

Intermediate Range Monitoring (IRM) System

Chapter 5.2

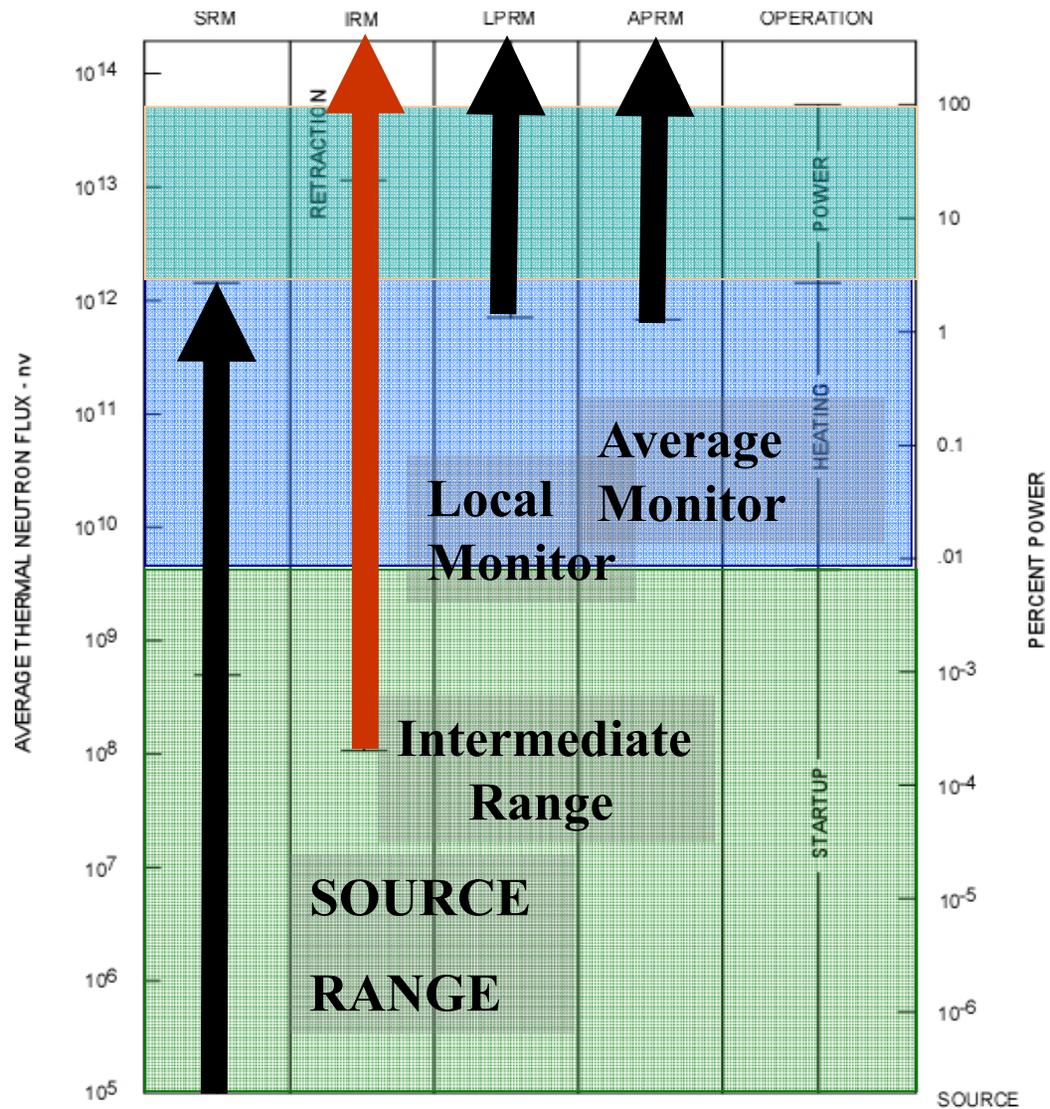
Objectives

1. State the purposes of the IRMs.
2. Explain how the method of ranging provides protection against rapid power increases.
3. Describe how the IRM's discriminate gamma from neutron flux
4. List the protective trips (scrams and rod blocks) generated by this system, the action caused by the trips, when the trips are bypassed and the reason for the trips
5. Explain the interfaces this system has with the following plant systems:
 - a. Reactor Protection System (RPS)
 - b. Reactor Manual Control System (RMCS)
 - c. Emergency Distribution System (EDS)
 - d. Source Range Monitoring System (SRM)

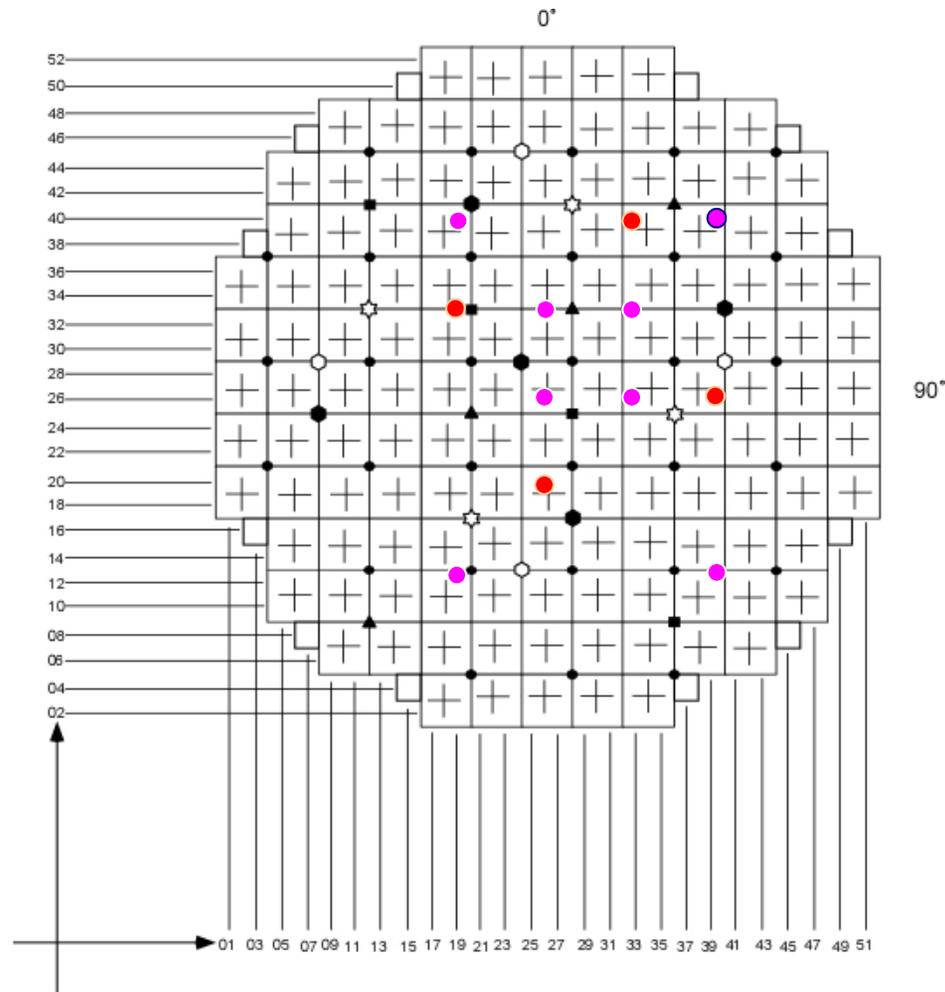
Purpose

- Provide neutron flux indications from the upper portion of the source range to the lower portion of the power range
- Provide scram signals to RPS to preserve the integrity of the fuel cladding
- Provide rod block signals to the RMCS to preserve the integrity of the fuel cladding

Neutron Monitoring System Ranges



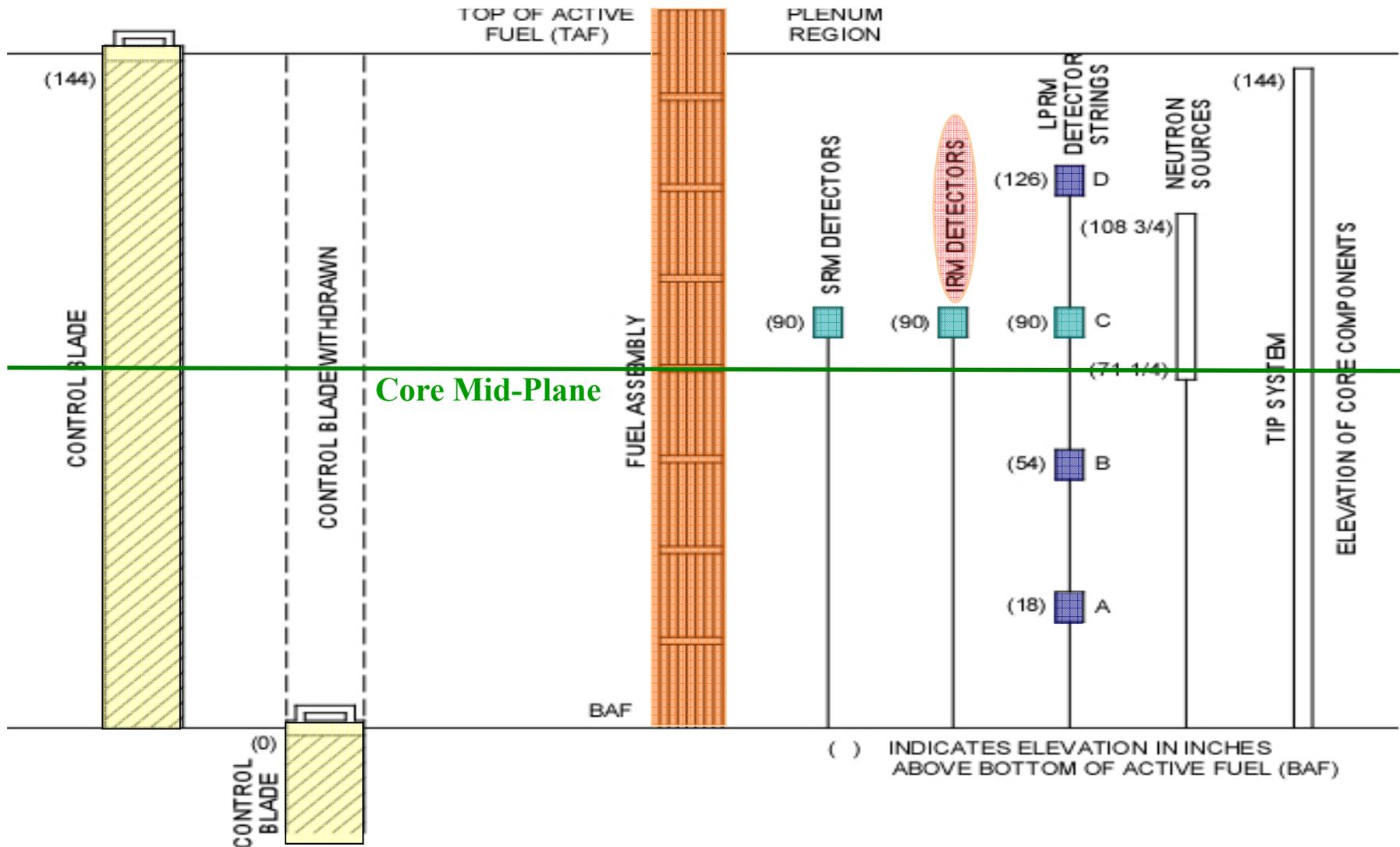
Detector and Control Element Arrangement



- ⊕ Control Rod
- LPRM String
- ▲ IRM Detector
- ☆ SRM Detector
- Sources
- Alternate Source Location

8
4

Axial Arrangement of Neutron Monitoring System Components



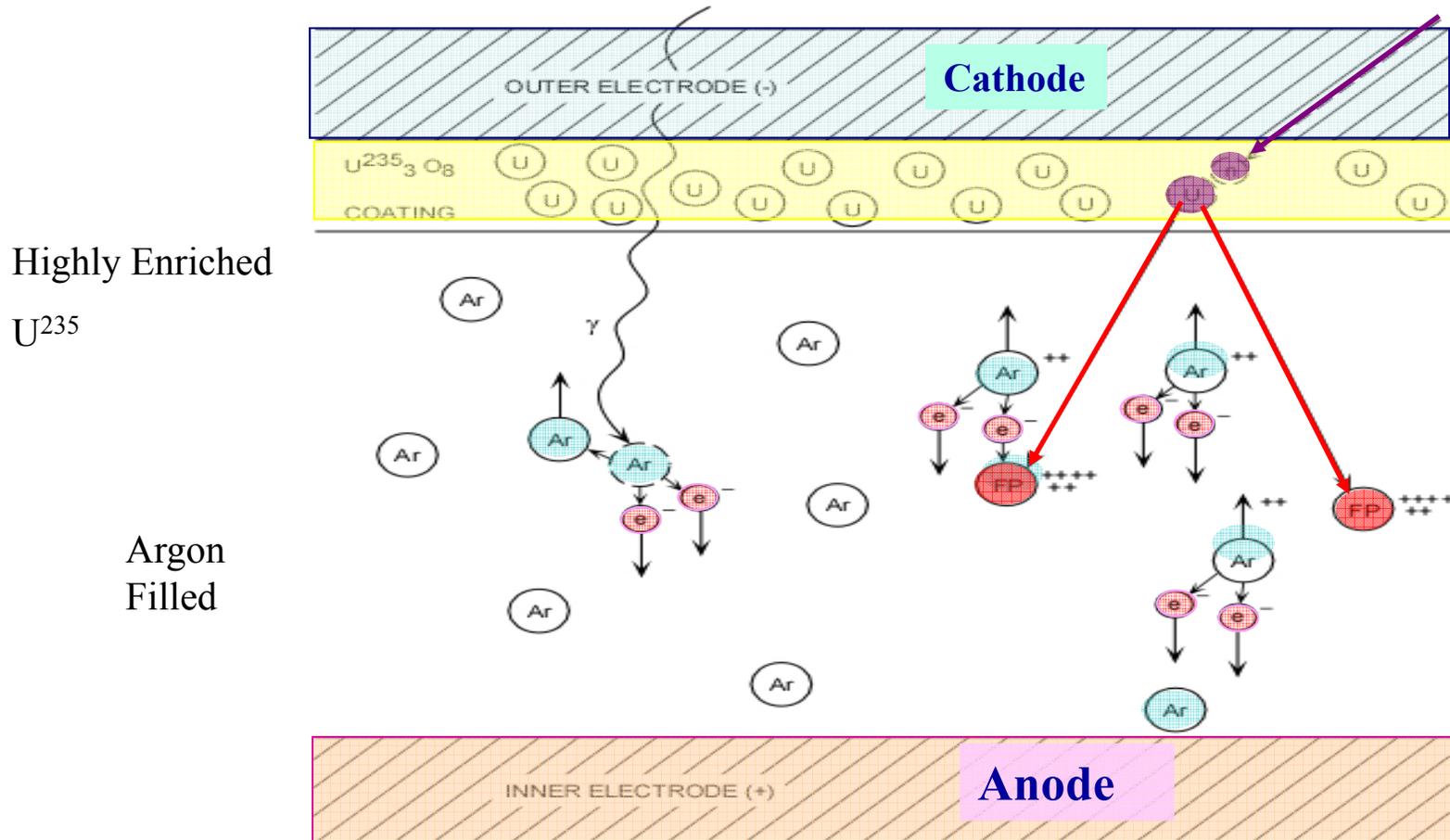
8 Detectors

☞ IRM Detector

1. Drive same SRM
2. Has Argon at lower pressure (17.7 psia)
3. Lower Uranium content
4. Cathode and Anode are closer together
5. Allows operation at higher power

☞ Otherwise the same ...

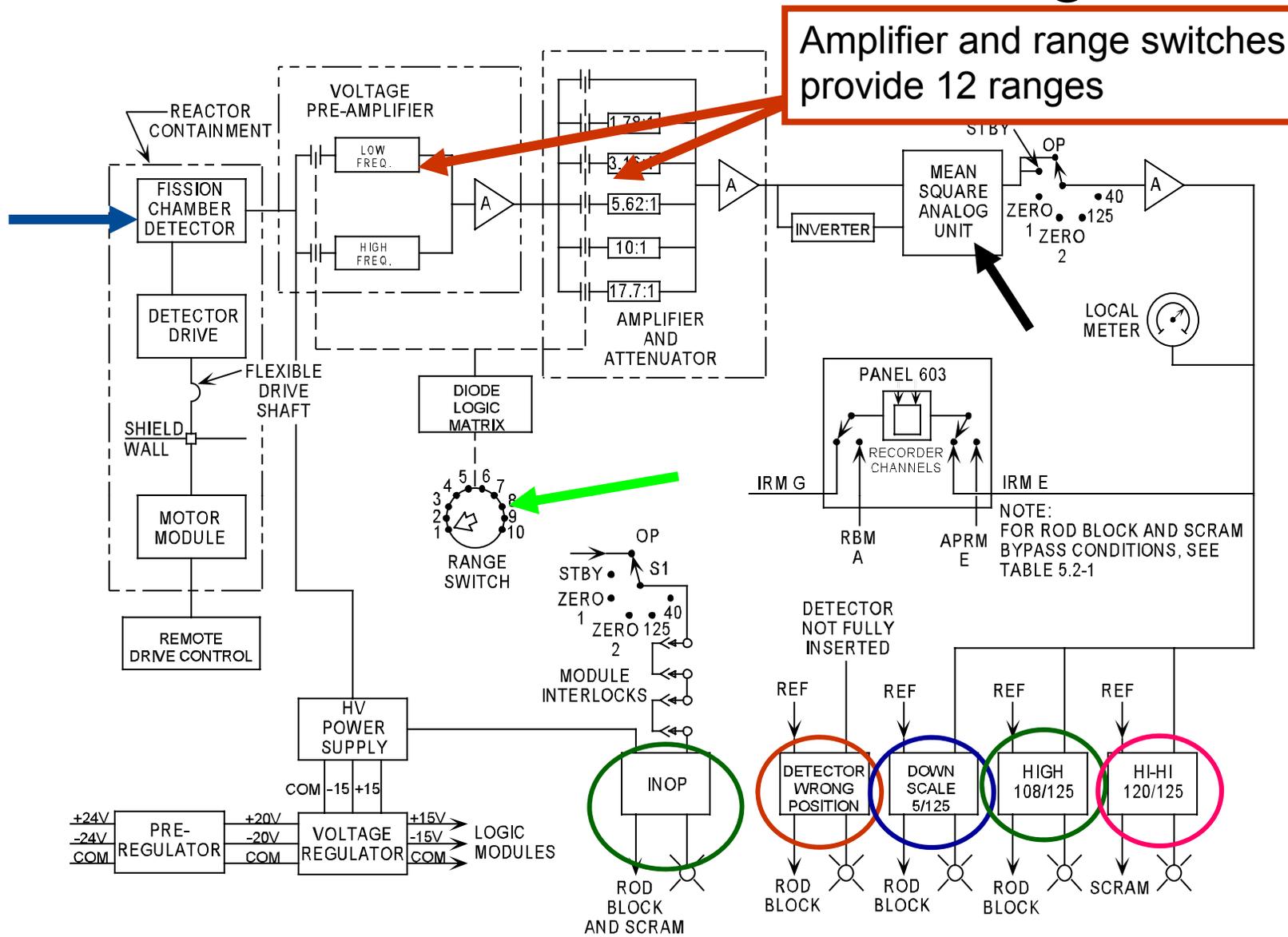
Fission Chamber Operation Review



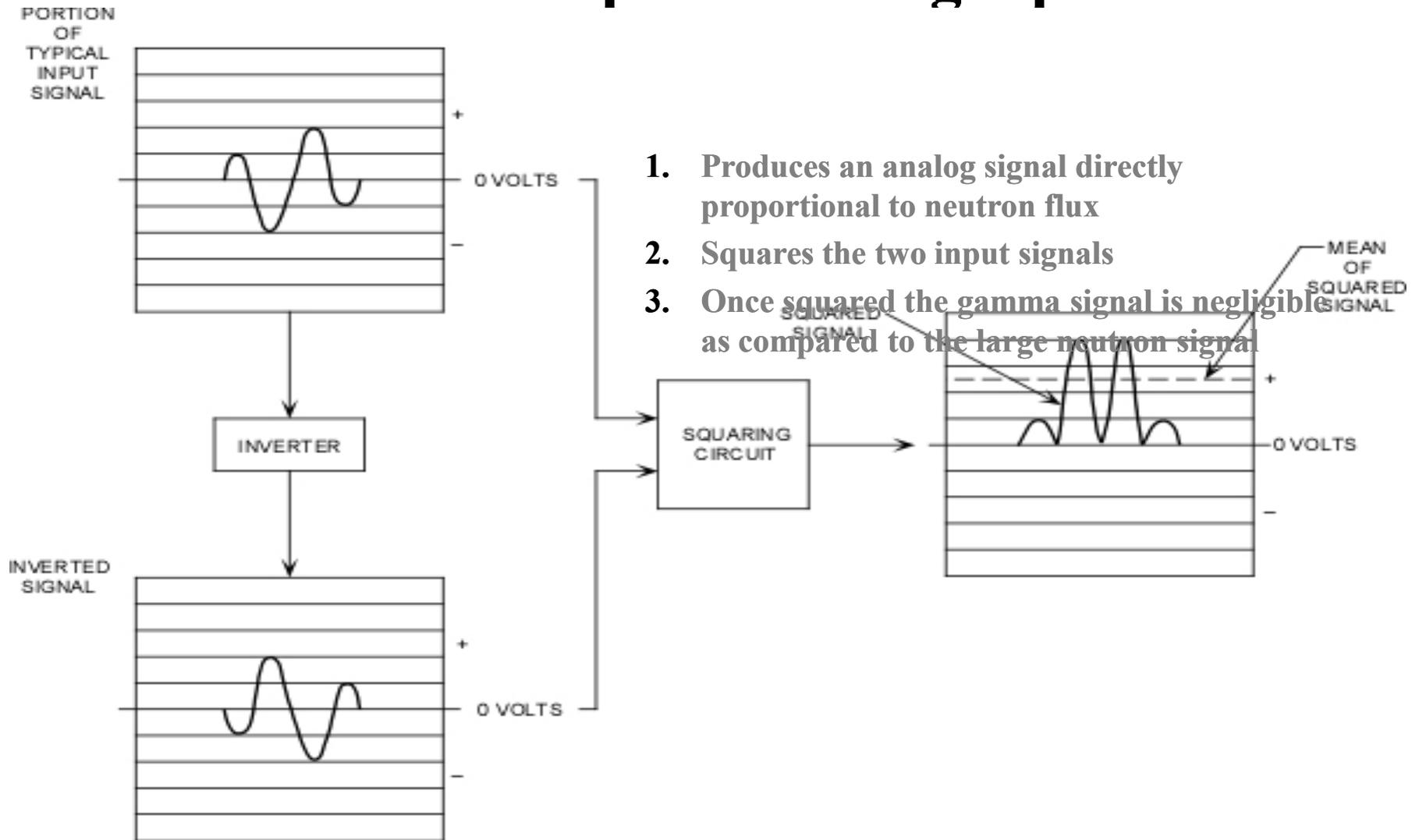
DETECTOR DATA

90% ENRICHED IN U-235
INTERNAL PRESSURE 215 psi
LENGTH 1.6 INCHES
WIDTH 0.16 INCHES

IRM Channel Functional Block Diagram



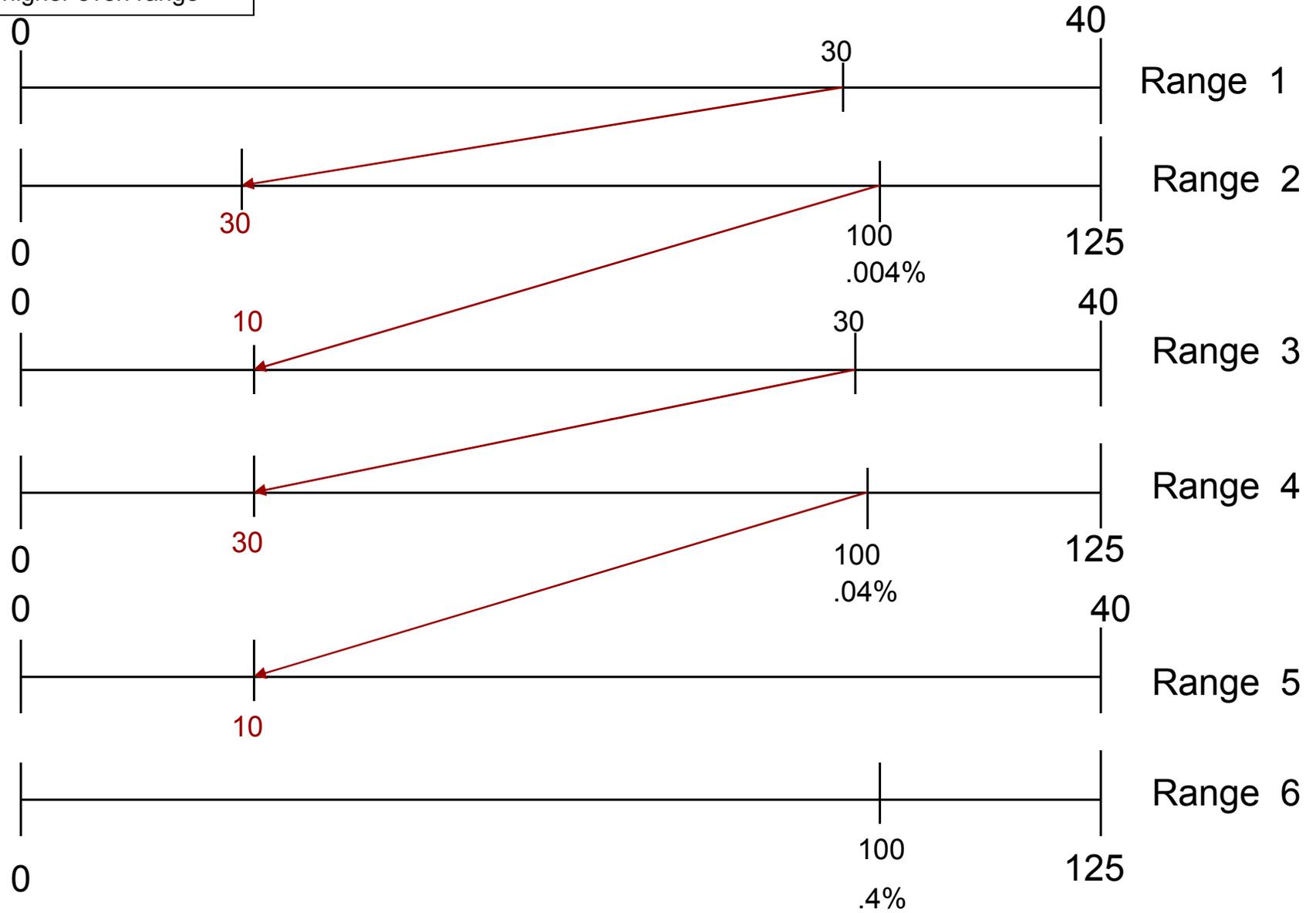
Mean Square Analog Operation



1. Produces an analog signal directly proportional to neutron flux
2. Squares the two input signals
3. Once squared the gamma signal is negligible as compared to the large neutron signal

IRM Ranges

Odd ranges overlap the next higher even range



IRM Interlocks and Trips

ALARM OR TRIP (1)	SETPOINT	IRM CHASSIS INDICATION (2)	Panel 603 INDICATION (3)	ANNUNCIATOR (4)	ACTION (5)	AUTO BYPASS
IRM Upscale Trip (High-scram)	≤ 120 of 125 scale	UPSCALE Trip (Red Light) (A-H)	UPSC TR or INOP (A-H)	IRM UPSCALE Trip or INOP (A or E, B or F, C or G, D or H)	Scram	Mode Switch in RUN or Bypass sw. in Bypass
IRM Upscale Alarm (High rod block)	≤ 108 of 125 scale	UPSCALE Alarm Amber light (A-H)	UPSC Alarm	IRM Upscale	Rod Withdrawal Block	Mode Switch in RUN or Bypass sw. in Bypass
IRM Downscale (rod block)	≥ 5 of 125 scale	DOWNSCALE (White Light)	DNSC	IRM DOWNSCALE	Rod Withdrawal Block	IRM on range 1 or Mode switch in RUN or Bypass sw. in Bypass
IRM INOP (Scram and rod block)	(6)	INOP (White Light) (A-H)	UPSC TR or INOP (A-H)	IRM Upscale Trip or INOP (A/E, B/F, C/G, D or H)	Rod Withdrawal Block ----- ---- Scram	Mode switch in RUN or Bypass sw. in Bypass
IRM Bypassed	Bypass Switch (7)	Bypassed (White Light)	Bypass (A-H)		Bypasses all trip functions of the IRM (One channel per division)	

Notes for table

- 1. All trips automatically reset when the trip condition is cleared.
Trip indicators on the IRM chassis must be manually reset.**
- 2. The trip status lights on the IRM drawer front panel operate regardless of mode switch position.**
- 3. Operation of all Pnl 603 trip status lights are bypassed with the mode switch in the RUN position.**
- 4. All IRM annunciators are bypassed with the mode switch in the RUN position.**
- 5. IRM retraction produces a Rod Block except when the mode switch is in the RUN position or the channel is bypassed.**
- 6. This is produced by the following:**
 - (a) IRM mode switch not in operate**
 - (b) High voltage low (<80 VDC)**
 - (c) Module unplugged**
- 7. Only one IRM in each channel (A or B) may be bypassed.**

System Interfaces

Reactor Protection System (Section 7.3)

- The RPS receives scram signals for IRM Upscale Hi Hi and INOP.

Reactor Manual Control System (Section 7.1)

- The RMCS receives rod block signals for IRM Hi, INOP, detector not fully inserted and downscale.

Emergency Distribution System (Section 9.2)

- The Emergency Distribution System supplies power to operate the IRM detector drive mechanism.

Source Range Monitoring System (Section 5.1)

- The SRM System receives signals from IRM range switch position. These signals automatically bypass the SRM rod blocks.

OBJECTIVE REVIEW

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